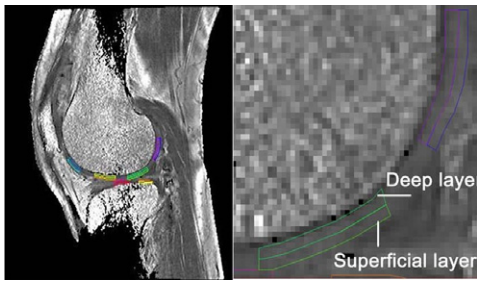
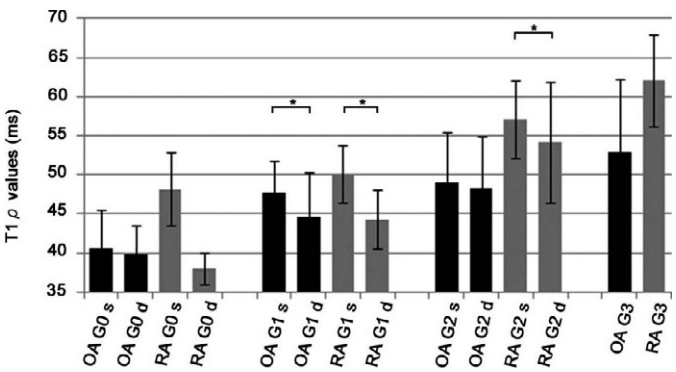
as well as possible regional differences in cartilage matrix structure. Quantification of regional variations in hip cartilage T1rho indicate that the regional analysis gives more thorough insight into articular cartilage composition than a global analysis alone and the technique may be useful in classifying patients based on region-specific cartilage degeneration.

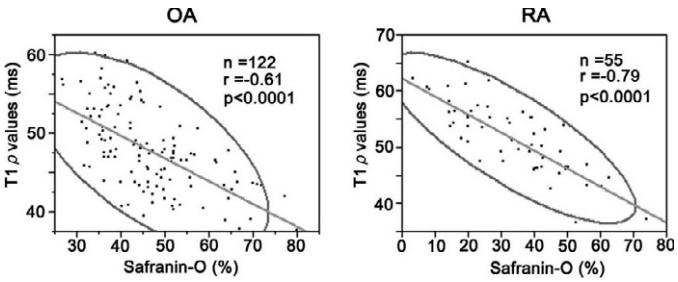
403
EVALUATION OF CARTILAGE DEGRADATION IN ARTHRITIS USING T1ρ MAGNETIC RESONANCE IMAGING MAPPING

K. Okazaki, H. Tsushima, T. Ushijima, Y. Iwamoto. *Kyushu Univ., Fukuoka, Japan*

Purpose: T1ρ magnetic resonance imaging (MRI) can be used to map proteoglycan (PG) loss in cartilage. However, recent studies have used comparatively large region of interests (ROIs) in cartilage even though cartilage degradation in severe OA subjects has been demonstrated to be heterogeneous. The purpose of this study was to confirm that T1ρ MRI is a useful method for mapping cartilage degradation in arthritis by comparing T1ρ values, the degree of macroscopic cartilage changes and semi-quantitative measurements of PG in the corresponding relatively small ROIs.
Methods: Tissue samples were obtained from 5 RA patients and 14 OA patients following total knee arthroplasty (TKA). Three parameters were measured: First, macroscopic grading of cartilage sample tissues was performed on a 5-grade scale (G0: normal, G1: swelling, G2: superficial fibrillation, G3: deep fibrillation, G4: subchondral bone exposure). Second, semi-quantitative values of PG were assessed by measuring the optical density of Safranin-O stained paraffin sections that had been digitally photographed. Third, cartilage was divided into superficial and deep layers and the T1ρ values were quantified.
Results: T1ρ values of OA and RA in the superficial layers showed significant differences between groups (G0/1 and G0/2 for OA; G0/2 and G1/2 for RA). In the deep layers, T1ρ values of OA and RA also differed significantly between groups. In both the superficial and deep layers, there was a significant correlation between the mean T1ρ values and macroscopic grading ($p < 0.01$ for OA, $p < 0.001$ for RA). We also found a negative correlation between the score of Safranin-O staining and T1ρ values ($r = -0.61$ for OA, $r = -0.79$ for RA). In addition, RA subjects had significantly higher T1ρ values than OA subjects of similar morphologic grade.
Conclusions: T1ρ MRI is able to detect and map the early stages of cartilage degradation in OA and RA subjects. This method is reliable and useful for the evaluation of macromolecular changes in arthritic cartilage.







404
MENISCAL MOVEMENT IN THE LOADED KNEE

E.A. Semple, J.S. Gregory, G.P. Ashcroft, F.W. Smith, A.G. Sutherland, R.M. Aspden. *Univ. of Aberdeen, Aberdeen, United Kingdom*

Purpose: To determine the effect of weight-bearing on the position of the menisci using positional MRI (pMRI). We measured movement of the menisci between a supine and an upright, weight-bearing posture and during weight-bearing flexion of the knee.
Methods: Left knees of 6 subjects (2 male, 4 female, 18–40 years) with no history of knee injury were scanned with pMRI (Fonar 0.6 T Upright). 7 sagittal images were taken through each femoral condyle using a T1-weighted fat suppressed sequence. Subjects were scanned supine, then weight-bearing with knees in extension and in 30°, 60° and 90° of flexion. 3D reconstructions were generated using Mimics (Materialise, Sheffield, UK) and measurements of meniscal and tibial position taken using the flexion facet centre (the centre of a circle fitted to the posterior arc of the femoral condyle) as a reference. Antero-posterior measurements were obtained for all subjects, heights and lateral measurements for 4. Results are expressed as mean (SD) and two way repeated measures ANOVA was used to test for significant differences between standing and supine and linear regression for changes with flexion (SigmaPlot v11).

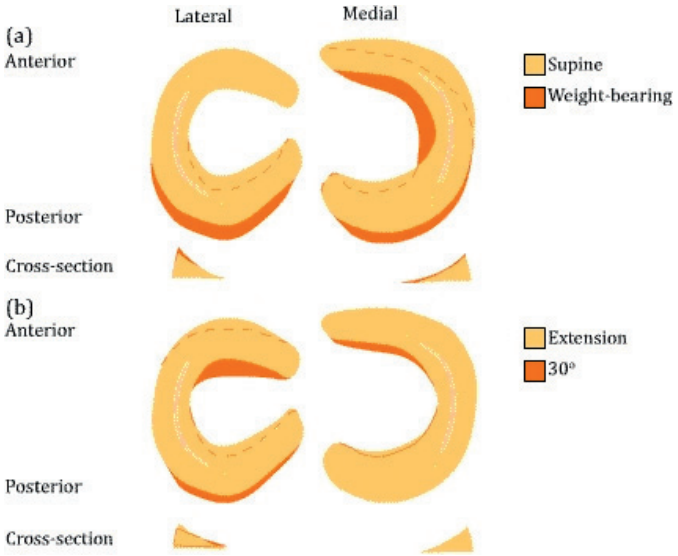


Fig. 1. Meniscal movement (a) between supine and weight-bearing and (b) with flexion viewed in the transverse plane and in cross-section.

Results: The 3D reconstructions showed posterior movement of the menisci relative to the femur with flexion in the weight-bearing knee. ANOVA and regression results are summarised in Figure 1. Between supine and weight-bearing, meniscal height increased by 1.19 (0.53) mm ($P = 0.005$) for the lateral and 0.31 (0.26) mm ($P = 0.32$) for the medial meniscus. The inner border of the medial meniscus moved towards the centre of the joint by 2.4 (2.2) mm ($P = 0.048$). The posterior horns widened posteriorly ($P = 0.011$), the lateral by 1.9 (2.4) mm and the medial by 1.6 (2.2) mm. The medial anterior horn moved posteriorly by 2.8 (2.1) mm ($P = 0.02$) and 3.2 (3.8) mm ($P = 0.014$) for the posterior and anterior borders respectively, resulting in a narrowing of 0.4 mm.
With weight-bearing flexion the medial tibial plateau moved 0.94 mm superiorly ($R^2 = 0.42$, $P < 0.001$) and the lateral plateau 3.8 mm anteriorly relative to the femur for every 30° of flexion ($R^2 = 0.68$, $P < 0.001$). The